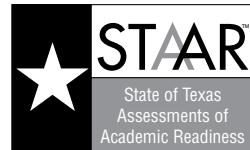


# STAAR PHYSICS REFERENCE MATERIALS



## FORCE AND MOTION

$$\text{Average velocity} = \frac{\text{displacement}}{\text{change in time}} \qquad v_{\text{avg}} = \frac{\Delta d}{\Delta t}$$

$$\text{Acceleration} = \frac{\text{final velocity} - \text{initial velocity}}{\text{change in time}} \qquad a = \frac{v_f - v_i}{\Delta t}$$

$$\text{Acceleration} = \frac{(\text{final velocity})^2 - (\text{initial velocity})^2}{2(\text{displacement})} \qquad a = \frac{v_f^2 - v_i^2}{2\Delta d}$$

$$\text{Displacement} = \left( \frac{\text{initial velocity}}{\text{velocity}} \right) \left( \frac{\text{change in time}}{\text{in time}} \right) + \frac{1}{2} (\text{acceleration}) \left( \frac{\text{change in time}}{\text{in time}} \right)^2 \qquad \Delta d = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$\text{Centripetal acceleration} = \frac{(\text{tangential velocity})^2}{\text{radius}} \qquad a_c = \frac{v_t^2}{r}$$

$$\text{Net force} = (\text{mass})(\text{acceleration}) \qquad F_{\text{net}} = ma$$

$$\text{Work} = (\text{force})(\text{distance}) \qquad W = Fd$$

$$\text{Torque} = (\text{force})(\text{lever arm}) \qquad \tau = Fr$$

$$\text{Power} = \frac{\text{work}}{\text{time}} \qquad P = \frac{W}{t}$$

$$\text{Pythagorean theorem} \qquad a^2 + b^2 = c^2$$

## GRAVITATIONAL, ELECTRICAL, AND MAGNETIC FORCES

$$\text{Force of gravitational attraction between 2 objects} = \left( \frac{\text{universal gravitation constant}}{\text{}} \right) \left( \frac{\left( \frac{\text{mass of 1st object}}{\text{}} \right) \left( \frac{\text{mass of 2nd object}}{\text{}} \right)}{\left( \frac{\text{distance between centers of objects}}{\text{}} \right)^2} \right) \qquad F_g = G \left( \frac{m_1 m_2}{d^2} \right)$$

$$\text{Force between 2 charged particles} = \left( \frac{\text{Coulomb's constant}}{\text{}} \right) \left( \frac{\left( \frac{\text{charge of 1st particle}}{\text{}} \right) \left( \frac{\text{charge of 2nd particle}}{\text{}} \right)}{\left( \frac{\text{distance between particles}}{\text{}} \right)^2} \right) \qquad F_{\text{electric}} = k_C \left( \frac{q_1 q_2}{d^2} \right)$$

$$\text{Electrical power} = (\text{voltage})(\text{current}) \qquad P = VI$$

$$\text{Current} = \frac{\text{voltage}}{\text{resistance}} \qquad I = \frac{V}{R}$$

$$\text{Equivalent resistance for resistors in series} \qquad R = R_1 + R_2 + R_3 + \dots$$

$$\text{Equivalent resistance for resistors in parallel} \qquad \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

# STAAR PHYSICS REFERENCE MATERIALS

## ENERGY AND MOMENTUM

$$\text{Kinetic energy} = \frac{1}{2}(\text{mass})(\text{velocity})^2$$

$$KE = \frac{1}{2}mv^2$$

$$\text{Gravitational potential energy} = (\text{mass}) \left( \begin{array}{l} \text{acceleration} \\ \text{due to gravity} \end{array} \right) (\text{height})$$

$$PE_g = mgh$$

$$\text{Elastic potential energy} = \frac{1}{2} \left( \begin{array}{l} \text{spring} \\ \text{constant} \end{array} \right) \left( \begin{array}{l} \text{distance stretched} \\ \text{or compressed} \end{array} \right)^2$$

$$PE_{\text{elastic}} = \frac{1}{2}kx^2$$

$$\text{Energy} = (\text{power})(\text{time})$$

$$E = Pt$$

$$\text{Work} = \text{change in kinetic energy}$$

$$W = \Delta KE$$

$$\text{Mechanical energy} = \text{kinetic energy} + \text{potential energy}$$

$$ME = KE + PE$$

$$\text{Law of conservation of energy}$$

$$KE_i + PE_i = KE_f + PE_f$$

$$\text{Momentum} = (\text{mass})(\text{velocity})$$

$$p = mv$$

$$\text{Impulse} = (\text{force})(\text{change in time}) = (\text{mass})(\text{change in velocity})$$

$$J = F\Delta t = m\Delta v$$

$$\text{Law of conservation of momentum}$$

$$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$$

$$\text{Heat gained or lost} = (\text{mass}) \left( \begin{array}{l} \text{specific} \\ \text{heat} \end{array} \right) \left( \begin{array}{l} \text{change in} \\ \text{temperature} \end{array} \right)$$

$$Q = mc_p\Delta T$$

## WAVES AND LIGHT

$$\text{Velocity} = (\text{frequency})(\text{wavelength})$$

$$v = f\lambda$$

$$\frac{1}{\text{Focal length}} = \frac{1}{\text{distance to image}} + \frac{1}{\text{distance to object}}$$

$$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$$

$$\text{Energy} = (\text{mass})(\text{speed of light})^2$$

$$E = mc^2$$

# STAAR PHYSICS REFERENCE MATERIALS

## CONSTANTS AND CONVERSIONS

$$c = \text{speed of light} = 3.00 \times 10^8 \frac{\text{m}}{\text{s}}$$

$$g = \text{acceleration due to gravity} = 9.8 \frac{\text{m}}{\text{s}^2}$$

$$G = \text{universal gravitation constant} = 6.67 \times 10^{-11} \frac{\text{N} \cdot \text{m}^2}{\text{kg}^2}$$

$$k_C = \text{Coulomb's constant} = 8.99 \times 10^9 \frac{\text{N} \cdot \text{m}^2}{\text{C}^2}$$

$$m_E = \text{mass of Earth} = 5.97 \times 10^{24} \text{ kg}$$

$$r_E = \text{radius of Earth} = 6.37 \times 10^6 \text{ m}$$

$$\text{newton (N)} = \frac{\text{kg} \cdot \text{m}}{\text{s}^2}$$

$$\text{joule (J)} = \text{N} \cdot \text{m}$$

$$\text{watt (W)} = \frac{\text{J}}{\text{s}} = \frac{\text{N} \cdot \text{m}}{\text{s}}$$

$$\text{hertz (Hz)} = \frac{\text{cycle}}{\text{s}}$$

# STAAR PHYSICS REFERENCE MATERIALS

## PERIODIC TABLE OF THE ELEMENTS

	1A	2A	3A	4A	5A	6A	7A
1	H 1.008 Hydrogen	Be 9.012 Beryllium					
2	Li 6.941 Lithium						
3	Mg 24.305 Magnesium	Sc 44.956 Scandium	Ti 47.867 Titanium	Cr 50.942 Chromium	Mn 54.938 Manganese	Fe 55.845 Iron	Co 58.933 Cobalt
4	K 39.098 Potassium	Ca 40.078 Calcium	V 51.996 Vanadium	Cr 51.996 Chromium	Mn 54.938 Manganese	Fe 55.845 Iron	Ni 58.693 Nickel
5	Rb 85.468 Rubidium	Sr 87.62 Strontium	Zr 91.224 Zirconium	Nb 92.906 Niobium	Mo 95.96 Molybdenum	Tc (98) Technetium	Ru 101.07 Rhodium
6	Cs 132.905 Cesium	Ba 137.328 Barium	Y 88.906 Yttrium	Ta 178.49 Tantalum	Re 183.84 Rhenium	Os 190.23 Osmium	Ir 192.217 Iridium
7	Fr (223) Francium	Ra (226) Radium	Lr (262) Lawrencium	Dy (267) Dysprosium	Sg (271) Seaborgium	Bh (272) Bohrium	Mt (276) Meitnerium

Atomic number	14
Symbol	Si
Atomic mass	28.086

Silicon

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	H 1.008 Hydrogen	He 4.003 Helium																	
2	Li 6.941 Lithium	Be 9.012 Beryllium																	
3	Mg 24.305 Magnesium	Sc 44.956 Scandium	Ti 47.867 Titanium	Cr 50.942 Chromium	Mn 54.938 Manganese	Fe 55.845 Iron	Co 58.933 Cobalt	Ni 58.693 Nickel	Cu 63.546 Copper	Zn 65.38 Zinc	Ge 69.723 Germanium	As 72.64 Arsenic	Se 74.922 Selenium	Br 78.96 Bromine	Te 80.00 Tellurium	I 126.904 Iodine	Kr 83.798 Krypton	Xe 131.294 Xenon	Rn (222) Radon
4	K 39.098 Potassium	Ca 40.078 Calcium	V 51.996 Vanadium	Cr 51.996 Chromium	Mn 54.938 Manganese	Fe 55.845 Iron	Co 58.933 Cobalt	Ni 58.693 Nickel	Cu 63.546 Copper	Zn 65.38 Zinc	Ge 69.723 Germanium	As 72.64 Arsenic	Se 74.922 Selenium	Br 78.96 Bromine	Te 80.00 Tellurium	I 126.904 Iodine	Kr 83.798 Krypton	Xe 131.294 Xenon	Rn (222) Radon
5	Rb 85.468 Rubidium	Sr 87.62 Strontium	Zr 91.224 Zirconium	Nb 92.906 Niobium	Mo 95.96 Molybdenum	Tc (98) Technetium	Ru 101.07 Rhodium	Rh 102.906 Rhodium	Pd 106.42 Palladium	Pd 107.868 Silver	Ag 112.412 Cadmium	In 114.818 Indium	In 118.711 Tin	Sn 121.760 Antimony	Te 127.60 Tellurium	I 126.904 Iodine			
6	Cs 132.905 Cesium	Ba 137.328 Barium	Y 88.906 Yttrium	Ta 178.49 Tantalum	Re 183.84 Rhenium	Os 190.23 Osmium	Ir 192.217 Iridium	Ir 192.217 Iridium	Pt 196.967 Platinum	Pt 196.967 Platinum	Hg 196.967 Gold	Tl 200.59 Mercury	Tl 204.383 Thallium	Pb 207.72 Lead	Po 208.980 Bismuth	Po (209) Polonium	At (210) Astatine		
7	Fr (223) Francium	Ra (226) Radium	Lr (262) Lawrencium	Dy (267) Dysprosium	Sg (271) Seaborgium	Bh (272) Bohrium	Mt (276) Meitnerium	Ds (281) Darmstadtium	Rg (280) Roentgenium	Ds (281) Darmstadtium	Rg (280) Roentgenium								

Mass numbers in parentheses are those of the most stable or most common isotope.

Lanthanide Series

La 138.905 Lanthanum	57	58	Ce 140.116 Cerium	59	Pr 140.908 Praseodymium	60	Nd 144.242 Neodymium	61	Pm (145) Promethium	62	Sm 150.36 Samarium	63	Eu 151.964 Europium	64	Gd 157.25 Gadolinium	65	Tb 158.925 Terbium	66	Dy 162.500 Dysprosium	67	Ho 164.930 Holmium	68	Er 167.259 Erbium	69	Tm 168.934 Thulium	70	Yb 173.055 Ytterbium
Ac (227) Actinium	89	90	Th 232.038 Thorium	91	Pa 231.036 Protactinium	92	U 238.029 Uranium	93	Np (237) Neptunium	94	Pm (244) Plutonium	95	Am (243) Americium	96	Cm (247) Curium	97	Bk (247) Berkelium	98	Cf (251) Einsteinium	99	Es (252) Californium	100	Fm (257) Fermium	101	Md (258) Mendelevium	102	No (259) Nobelium